Re: Newark Bay Study Area – Comments to the Newark Bay Study Area Data Gaps Report, Revision 0 –March, 2013 prepared by Tierra Solutions, Inc. (TSI)

General Comments

1. The "Data Gaps Report" (DGR) is actually an assessment of whether DQOs/PQOs for the NBSA RI have been achieved. The stated objective of the DGR was to "evaluate that the requirement of the RI Goal 1 have been met and, if not, identify what data needs remain". There is no actual discussion of data gaps presented. While the evaluation of DQOs and PQOs is a component of a data gaps assessment, TSI's assessment fails to address the bigger picture question of whether sufficient data have been collected to support completion of the Remedial Investigation, Feasibility Study, and Human Health and Ecological Risk Assessments. The report presents a rather cursory evaluation of the data vis-à-vis gaps. It lacks the assessments needed to evaluate whether additional data are required to meet the quality objectives being considered. For each quality objective, the report cites to data analyses that have been done to examine correlations or differences in mean concentration. But, it makes no attempt to determine whether the data are sufficient to characterize the considered conditions. The biggest deficiency is that variability is not appropriately dealt with. The amount of data needed for characterization depends on the variability that exists. The greater the variability, the more data are needed to get confident estimates of concentration distributions, etc. to perform these evaluations. The assessment lacks statistical rigor.

2. Since the Phase I DQOs and Phase II PQOs were very broad (ex. "*better understand broad patterns of constituents*" and "*attempt to preliminarily identify 'hot spots' through statistical analysis*"), the conclusion is reached that the DQOs/PQOs for Phases I and II have been achieved and that, therefore, "*no further data are needed to satisfy the intent of RI Goal 1* [determine the horizontal and vertical distribution and concentration of PCDDs/PCDFs, PCBs, PAHs, pesticides and metals] *at this time*". However, a useful data gaps analysis has not been conducted to determine if the horizontal and vertical distribution characterized so far is adequate for preparing the Newark Bay FS. TSI has indicated that potential data gaps will be evaluated and addressed during Phase III of the NBSA RI/FS. If a Phase III is necessary, then clearly data gaps exist.

3. The sufficiency of the available data should be evaluated within the context of the conceptual site model to determine if the data support a system understanding. The data must be sufficient to describe the fate and transport processes that have historically and continue to control the observed chemical patterns. The CSM is a part of the nature and extent evaluation, and is critical to evaluate the completeness of the nature and extent evaluation. The data gaps report and the referenced DEAR report do not provide the conceptual structure to evaluate the sufficiency of the data.

4. The report relies heavily on statistical comparisons that do not seem to have much value. Data in a fixed depth interval are compared across geographic and geomorphic areas. Because there are great differences in sedimentation among samples, even samples within the same area[1], a fixed depth interval covers different time periods in each core. Therefore, differences in concentration may reflect differences in the age of the sediment as well as differences due to location or area. Thus, it is not clear what meaning to assign to the lack or presence of differences. Moreover, whether differences are found depends on the number of samples in each group and the variability within that group relative to

[1] The Sediment Deposition Report shows large differences among cores and great uncertainty in individual estimates of sedimentation.

the overall data set. Thus, the interpretation of the statistical tests is confounded in ways not considered.

5. Based on the size and heterogeneity of the habitats in the Bay, it seems unlikely that sufficient data have been collected to complete the risk assessments. For example, TSI presented sediment summary statistics in relation to Ecological Screening Criteria in DEAR Tables 4-3a-h. However, the Revised DEAR does not present any analysis of how chemical concentrations compare to these criteria, or whether adequate data are available for the risk assessment. The dataset should be evaluated with respect to anticipated data needs for completing the risk assessment.

6. The report states that the Risk Assessment will include sampling, analysis and evaluation of chemicals not considered in the evaluation of data gaps. It seems inappropriate to expand the scope to include such chemicals when they are not subject to the DQO process and the Agency has not identified these as COPCs.

7. The CPG Modeling Team is in the process of updating the NBSA portion of the LPR/NB Model including a review of existing data as well incorporating EPA's recently collected NBSA Sedflume data and it is yet to determined whether the sediment data obtained through Phase I and Phase II are sufficient for completing the Sediment Transport and Chemical Fate and Transport models for the NBSA..

8. The report seems to take the wrong approach to determining whether there are gaps in sediment chemistry relative to the objective of confirming the presence and extent of geomorphic areas. The assessment of this objective should consider whether the chemistry data confirm the boundaries assigned based on other lines of evidence. Although it reports on whether there are statistically significant differences in average concentrations among the areas, it does not examine whether additional data are needed to support cross-area comparisons or to confirm the boundaries between areas.

9. The report provides no assessment of whether concentration patterns have been adequately characterized. Again, it relies on the testing for statistically significant differences among areas, which provides no understanding of whether patterns within each of the areas have been adequately characterized. Nor does it address the issue of whether the spatial coverage is sufficient to understand concentration patterns across geographically separated components of each geomorphologic area. For example, a number of the disturbed sub-tidal flats have no samples and others have only one or two samples. The sufficiency of the existing data cannot be assessed without a conceptual understanding of the fate and transport processes that drive the observed concentration patterns to determine if the existing data support this understanding, or if significant uncertainty exists such that additional data is needed to more fully understand these processes.

10. Whether there are sufficient data to estimate the depth of the 1940 horizon in each geomorphic unit depends on the variability of that depth within each unit. The greater the variability, the more data are needed to characterize the depth. The report provides no assessment of this variability and the confidence provided by the existing data.

11. TSI itself has acknowledged that additional work is necessary to complete the RI. Section 5 of the ICSM concludes with a recommendation that future work be focused on "depositional areas within historically disturbed subtidal flats, and within the industrial waterfront areas of the Arthur Kill, southern Newark Bay, and the northwestern portion of the Newark Bay North". The ICSM did not identify the

objectives of said work, or provide any justification or rationale for this assertion. Data needs for the areas identified in the ICSM should be identified in the DGR.

12. None of TSI's documents (e.g. Revised DEAR, ICSM) have included any discussion of chemical fate and transport, or the interrelationship between sediments and other media (i.e. surface water, tissue). Interactions between media have not been characterized but are critical to completing the RI/FS and risk assessments. Data needed to characterize these interactions should be identified as a data gap at this point in the RI. The revised ICSM should include a discussion of contaminant partitioning between sediment and surface water, predicted controls on bioavailability of the primary Chemical of Potential Concern (COPCs) (e.g. Hg, PCBs, TCDD), COPC transport mechanisms, etc. Identification of the processes that may play a role in chemical transport and fate in the NBSA would facilitate identification of data gaps and aide in the formulation of study questions to direct future phases of investigation.

13. Given some of the statistical uncertainties, it remains unclear if dividing the bay into geographic segments adds materially to the understanding of the system. Fingerprinting of dioxin sources in Newark Bay has been performed by a number of investigators, and comparison of general congener patterns clearly shows that the Lister Avenue fingerprint is evident throughout the Bay (Figure 1). Ratio plots of 2,3,7,8-TCDD to Total TCDD (Figure 2A) as well as total 2,3,7,8 TCDD concentrations (Figure 2B) show a clear trend indicating contamination from 80 Lister Avenue has been transported the length of Newark Bay and into the Kills. This finding supports a conclusion that contaminant transport and distribution in the Bay must be evaluated on a site-wide basis, rather than in discrete geographic areas. The large amount of data collected includes dioxin congeners that are detectable at a high frequency but incompletely evaluated in the data assessment.

Comments Related to Specific DQOs/PQOs

1. Phase 1 DQO 3/Phase 2 PQO 2: The objective of this DQO/PQO was to assess broad patterns of constituents in surface/subsurface sediments and preliminarily identify hotspots. TSI concluded these objectives had been met and that there were no data gaps related to these objectives. The data presented in the DEAR and the ICSM do not support this conclusion for several reasons as outlined below:

    a. The statistical evaluation that compares concentrations of COPCs in different geographic and geomorphic locations provides some qualitative information regarding comparative COPC levels in various portions of the NBSA, or in different settings within the NBSA, but the evaluation does not provide definitive evidence that any portion or sub-region within the NBSA is necessarily any different than another. A number of observations support this comment:

        i. Sample size: the number of sampled locations is inadequate to complete the RI. The current dataset is insufficient to conclusively differentiate between areas. Based on information from the DEAR, samples were collected from a total of 119 locations within the bay, and 60 +/- within the two-mile radius. The approximate sample density in the bay is 0.03 samples/acre, LPRSA RI sediment data have been collected at a density 0.33 samples/acre since 2007 which is 10 times greater than the density of the NBSA sampling density[2]. Furthermore, evaluation of the spatial distribution of these sample numbers show that 30 to 40 locations represent very large geographic areas of the bay (i.e. North, Central, and South), and as few as 3 locations represent some geomorphic

[2] EPA has been in discussions with the CPG to conduct additional sediment data above RM 8.3 for additional sampling for nature and extent to support remedy selection.

areas (i.e., Intertidal). In particular, the sediment accumulation areas identified in Figure 3-3 of the DGR may warrant additional characterization. Given the limited number of cores in some geomorphic (e.g. Industrial Water Front) or depositional areas, it is questionable whether these data are adequate for characterization. It is therefore difficult to conclude that representative sampling of the geomorphic and geographical areas is complete.

ii. Sample location bias: The selection of specific sampling locations, and their suitability for representing the site and for grouping of stations in the data analyses, is not well supported. The sampling locations represent a combination of randomly-selected and targeted locations. Upon review of the figures showing the sampling locations in the bay, it is difficult to conclude that the samples in the South Bay, many of which appear to be along the shoreline, are equivalent to those in the North Bay, where many are in the middle of the bay. Statistical comparison of these two potentially different sample populations may not be appropriate.

Furthermore, data from the Lower Passaic River, as well as data from several other studies completed by others in Newark Bay and connected waterways, have been incorporated into the analysis presented in the DEAR. The addition of data from other studies provides some additional samples in locations where TSI did not previously have data, but results in high data density in localized areas. The Honeywell investigation in the northeast portion of the Bay is the most obvious example of this uneven sample distribution. This clustering of samples may result in bias in terms of statistical evaluation of data.

iii. Influence of individual samples: Given the range of concentrations observed (one to four orders of magnitude, depending on COPC) and the small sample size, the statistical mean in a specific area or region may be strongly influenced by a handful of samples.

iv. Selection of comparison areas: The geomorphic or strict geographic separation is not the most suitable for grouping stations and samples for analysis and discussion purposes. Sediment and contaminant dynamics (i.e., sediment transport, erosion/ deposition characteristics, and similarity in the likely sources of the contamination) may be more suitable for analyzing and interpreting the data. Although geographic classifications are useful for general discussion purposes and to aid in the assessment of whether gross contamination from local source(s) may be a factor, the sediment transport in the system (and geographic similarities in such transport mechanisms) and sediment characteristics are likely more important for understanding the distribution of the sediment contamination.

v. Statistical significance: TSI's conclusions of "statistically significant" differences do not seem valid. For example, 460 ppb and 1.3 ppm for Aroclor PCBs are not much different especially in light of the potential for bias as discussed above. Tables 4.7 a-e in the DEAR show some differences between areas, but the results can only be viewed as qualitative due to the uncertainties identified above. Statistical robustness: Questions about the robustness of the statistical evaluations cast uncertainty on the conclusions that statistically higher chemical concentrations were found in sediments in Newark Bay South, west of the navigation channel and in USACE accumulation areas.

2. Phase 1 DQO 4: The objective of this DQO was to assess whether the current analytical suite is appropriate. TSI asserts that there are no data gaps and that the current analytical suite is appropriate for each geomorphic area. The proposed analytical suite moving forward in the RI/FS should be clarified – is it the modified list from Phase II or the 18 chemicals evaluated in the revised DEAR? If the latter, no formal COPC assessment of how the list was reduced to these 18 chemicals was provided in the DEAR and would need to be provided.

   Additionally, both Section 1 of the DGR and Section 5.1 of the ICSM present information on the potential importance of emerging contaminant data (ex. polychlorinated naphthalenes and polybrominated diphenyl ethers). The addition of emerging chemicals is not mentioned in Section 3.4 or Table 3-1 of the DGR. If TSI has identified emerging contaminant data as a data need, it should be included here along with a rationale that describes why these data are necessary and if these are expected to be risk drivers.

3. Phase 2 PQO 3: TSI concludes that matrix heterogeneity in the Bay has been adequately characterized, and that no additional sampling or analysis is required. A comparison of Phase I and Phase II sediment investigation co-located cores is presented in DEAR Table 4-9, and TSI concludes that the Bay is heterogeneous with respect to chemical concentrations. However, the analysis presented in the DEAR provides a limited understanding of heterogeneity throughout the Bay, and more data analysis is warranted to determine whether this PQO has been achieved. For example, no discussion is presented in relation to whether heterogeneity varies among geomorphic or geographic areas. Areas with higher heterogeneity in sediment COPC concentrations may warrant additional sampling and analysis. Use of geostatistics is typically employed to assess the spatial and temporal dependence between sample points and further helps determine what the appropriate sample density is for any geomorphic area.

In summary, there are a number of serious shortcomings with respect to the Data Gaps Report which should be remedied by additional analysis of the existing data and preparation of a more meaningful and appropriate data gap analysis. This revised data gap analysis can then inform development of study questions and scope of work for any Phase III investigation that may be warranted.